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**METHOD FOR PRODUCING COATED PRINTING PAPER**

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## Abstract

[Task] A method for producing coated printing paper at high-efficiency productivity equal to blade coater coating process is provided.

[Solving means] Coated printing paper is produced at a high efficiency from base paper containing at least 50% wastepaper per the absolutely dried weight of the paper using a curtain coater as the coating mode.

## Claim

1. A method for producing coated printing paper, characterized in that in a method for producing coated printing paper by forming a coating layer mainly comprising pigments and an adhesive on base paper, paper containing at least 50% wastepaper is used as the base paper, and the coating layer is formed by a curtain coater.
2. A method for producing coated printing paper described in claim 1, characterized in that the coating layer is formed by coating with a coating solution with a solids concentration of 55-70% by weight using a curtain coater.

## Detailed explanation of the invention

### [0001]

[Technical field of the invention] The present invention relates to a method of producing coated printing paper, more specifically to a method of producing coated printing paper at a high productivity equal to the blade coater coating process.

### [0002]

[Prior art] Coated paper has been widely used as printing paper in the past since it is superior in smoothness to uncoated paper and its ink absorptivity is uniform. In recent years, the quality requirement for coated printing paper has been intensified more and more with the promotion of visualization, coloration and grade enhancement of printed matters. Particularly, photo plates have been widely used in printed matters such as magazines, photo album, books, etc. and commercial printed matters such as catalogues, posters, calendar, etc., and the halftone dot reproducibility and ink impression become important points for printed matters. Accompanied with this, the requirement for

improvement of the smoothness, ink acceptability and printing gloss of coated printing paper has been further raised. In addition, the international commercialization (price reduction) has been simultaneously promoted, and high-efficiency production has been desired. Thus, high-speed coating using a blade coater has been generally carried out, and the solid concentration heightening of coating solutions and the speeding-up of the coating rate have been accelerated.

[0003] On the other hand, pulp to be used in base paper for coated printing paper is made from cellulose pulp using wood chips as a raw material and pulp obtained from coated scrap paper generated in the manufacturing process of coated paper, but the use of wastepaper has been promoted due to the global environment preservation problem and garbage problem and the proportion of wastepaper in base paper has been increased. Especially, the amount of paper in municipal garbage has been rapidly increased accompanied by the progress of office automation, and a measure for enhancing the utilization rate of wastepaper has been demanded.

[0004] Wastepaper is classified into corrugated cardboard type wastepaper, high-quality wastepaper and newspaper-magazine type wastepaper, but the high-quality wastepaper and newspaper-magazine type wastepaper are used for production of base paper for coating paper.

[0008] When base paper prepared using a large amount of wastepaper is coated using a blade coater it often shows properties different from base paper prepared using a large amount of purged pulp. For example, in base paper containing a large amount of wastepaper, the surface strength of the base paper is lowered, and the contamination of the liquid circulation system and the catching of foreign matters at the blade tip occurs in blade coaters since fine fibers come off and those cause coating defects such as a scratch, etc. Therefore, in the case of base paper prepared by using a large amount of wastepaper, it hinders the high-efficiency production of coated paper.

[0006] When coated printing paper is produced using base paper prepared with a large amount of wastepaper, there is a problem in the operation as mentioned above, and there is a demand to develop a method for producing coated printing paper at high efficiency.

[0007]

[Problem to be solved by the invention] When a small amount of wastepaper is used as a portion of raw material pulp for base paper, it does not cause any problem in the operation of the production of coated paper. But when a large amount of wastepaper is used, small fiber lumps mixed in wastepaper, foreign matters which can not be removed, or small black lumps formed by hardening of sticky materials such as gum tape, etc. are spread in base paper for coating, and those are scraped off during coating by a blade coater to admix in a coating solution in the circulation system or to adhere to the tip of blades to cause a coating defect such as a streak, scratch, etc. and to lower the yield of products. There are air knife coaters, rod coaters, etc. as the coating mode rather than the blade coater, but similarly the liquid circulation system is contaminated and also the coating velocity is slower than that with the blade coater and, therefore, the productivity is lowered.

[0008] Thus, the purpose of the present invention is to provide a method for producing coated printing paper with a high productivity by coating a coating solution on the base paper, which is obtained by using a large amount of wastepaper, at a high velocity without forming a coating defect on the base paper and without energy loss during drying.

[0009]

[Means for solving the problem] Present inventors had assiduously conducted a study to solve the aforementioned problem to obtain the present invention. Namely, the method for producing coated printing paper in the present invention is characterized in that in coated printing paper obtained by forming a coating layer comprising pigments and an adhesive on base paper, paper containing at least 50% wastepaper is used as the base paper, and the coating layer is formed by a curtain coater.

[0010] In the present invention, the coating layer is formed by coating a coating solution having a solids concentration of 55-75% by weight using a curtain coater.

[0011]

[Embodiment of the invention] The method for producing coated printing paper in the present invention is to form a coating layer on base paper made with at least 50% using a curtain coater. Wastepaper is made into pulp through processes such as de-inking, dedusting, bleaching, etc., and fine fibers, foreign matters, or minute black lumps formed by hardening sticky materials such as gum tape, etc. are mixed into pulp, which is different from so-called purged pulp. Thus, in the case of base paper prepared by using at least 50% wastepaper, the above-mentioned contaminants exist on the surface of base paper, and when a coating layer is formed on the base paper, those contaminate the circulation system or are caught to cause coating defects. Further, even when an air knife coater or a rod coater is used, the circulation system is contaminated and also the liquid concentration is restricted to a low level or the coating velocity is restricted to cause the quality reduction or productivity reduction. In contrast to this, in the present invention, coated paper for printing can be produced at a high efficiency without contaminating the liquid circulation system and without forming coating defects by combining a curtain coater for the formation of a coating layer since there is no liquid return.

[0012] A curtain coater to be used in the present invention is shown in Figure 1 or Figure 2. Figure 1 is a schematic drawing for a curtain coater utilizing an extrusion type coater head as an application example of the present invention. Further, Figure 2 is a schematic drawing for a curtain coater utilizing a slide type coater head as another application example of the present invention.

[0013] As it is seen from Figure 1 or Figure 2, the place, where a liquid is flowing through a regulated flow passage, is only a part of slit 2, which is a special feature of the curtain coater. The selection range of the slit width is wide, but it is generally 0.2 mm to 1 mm. In the curtain coating, a liquid discharged from lip 3 forms a free surface until it contacts with web 5 and thus the flow passage is not regulated. Contrasted to this, in a rod

or blade coater, the minimum interval between the rod or blade and the web, wherein the liquid weighing is carried out, it is generally less than or equal to 0.05 mm. Therefore, when coagulated materials or foreign materials exist in the liquid, the probability of a streak appearing is extremely low in the case of a curtain coater more than in the case of rod or blade coater.

[0014] Since the curtain coater is a pre-weighing type coater, only a small amount of the liquid discharged from the head is recovered and used. On the other hand, since the blade coater is a post-weighing type coater wherein a liquid is once excessively fed to the web and scraped off and the weighing is carried out, the recovering liquid amount is more than in the case of curtain coating. Further, when an excess amount of liquid is fed to the web in the blade coater, water or binder in the liquid is selectively absorbed to increase the concentration of the recovered liquid so that the coating solution is concentrated or foreign matters adhered to base paper surface are present in the recovered liquid to cause streaking. On the other hand, in the curtain coater, the concentration of the coating solution is not changed and stable coating is carried out even in a long-period operation.

[0015] The method for making base paper for coating is not particularly restricted in the present invention, and a paper-making method, which was commonly used from the past, can be employed. For example, acidic paper making, wherein paper making is carried out at pH of around 4.5, or so-called neutral paper making, wherein an alkali filler such as calcium carbonate, etc. is a principal ingredient and the paper making is carried out at a range of weak acidic to weak alkaline, namely pH of about 6-9, may be employed.

[0016] The base paper for coating of the present invention can be made into a paper sheet having a unit weight of 20-400 g/m<sup>2</sup> according to its use or purpose.

[0017] In the manufacture of base paper for coating in the present invention, pulp (KP), which is obtained by bleaching pulp obtained from ligno-cellulose materials such as needle-leaf tree or broad-leaf tree chips, etc., or non-ligneous cellulose materials such as bagasse, kenaf, reed, straw, etc. by alkali cooking such as kraft cooking, pulp (GP) obtained by bleaching mechanical pulp, and pulp(CGP) obtained from mechanical pulp

by chemically treating and bleaching, beside regenerated pulp from wastepaper, can be used as raw pulp. In the present invention, wastepaper is used at an amount of at least 50% based on the absolutely dried weight of base paper for coating. If the amount of wastepaper is less than 50%, it is unnecessary to apply the present invention since base paper has excellent property equal to that of base paper obtained without using wastepaper. The application amounts of various pulps other than wastepaper can be suitably selected according to the quality required of base paper for coating.

[0018] Further, in the manufacture of base paper for coating in the present invention, commonly used fillers can be used if necessary. For example, mineral fillers such as talc, kaolin, clay, calcined kaolin, delaminated kaolin, heavy calcium carbonate, light calcium carbonate, magnesium carbonate, aluminum hydroxide, titanium dioxide, magnesium silicate, white carbon, aluminosilicate, silica, bentonite, etc. and organic synthetic fillers such as polystyrene resin particles, urea-formalin resin particles, fine hollow particles, etc. can be used singly or in combination of two or more. Furthermore, fillers in wastepaper, etc. can be effectively used.

[0019] Beside those, conventionally used paper making additives such as various anionic, cationic, nonionic or amphoteric yield enhancing agent, filterability enhancing agent, paper strength enhancing agent, etc. may be suitable added into pulp slurry if necessary. As the paper-making additives, alum, aluminum chloride, sodium aluminate, basic aluminum compounds such as basic aluminum chloride, basic polyaluminum hydroxide, water-soluble aluminum compound such as water-dispersible alumina sol, etc., various starches, polyacrylamide, polyethyleneimine, polyamine, polyamide-polyamine, polyethylene oxide, vegetable gum, urea-formalin resin, melamine-formalin resin, polyvinyl alcohol, latex, polyamide resin, hydrophilic crosslinked polymer particle dispersed material, their derivatives or modified compounds, and bentonite are exemplified. Furthermore, dyes, pH controlling agents, pitch controlling agent, slime controlling agent, antifoaming agents, etc. can be suitably added if necessary.

[0020] Coated printing paper is produced by coating a coating solution containing pigments and an adhesive as the principal ingredients on one or both sides of the base paper of the present invention. The coating solution has a solids concentration of 55-70% by weight, preferably 60-65% by weight, from the aspect of quality, operational property, and energy efficiency. Namely, if the solids concentration of the coating solution is lower than 55% by weight, the amount of water to be evaporated increases and a problem of energy loss arises. Further, when the solids content exceeds 70% by weight, the coating solution closes up the slit during coating by a curtain coater to cause curtain crack, and it is difficult to carry out stable coating.

[0021] In the coating layer of coated printing paper, inorganic pigments such as calcium carbonate, clay, kaolin, calcined kaolin, satin white, titanium dioxide, talc, aluminum hydroxide, zinc oxide, zeolite, barium sulfate, amorphous pigment, etc. and organic pigments such as plastics pigment, hollow pigment, etc. can be used singly or in combination of two or more. In addition, generally known adhesives such as natural polymer type adhesives, e.g., oxidized starch, etherified starch, esterified starch, enzyme-modified starch, cold water-soluble starch obtained from the above starches by flash drying, casein, soybean protein, etc. and alkali-sensitive or alkali-insensitive adhesives such as various polymers, e.g., styrene-butadiene type, styrene-acrylic type, vinyl acetate-acrylic type, butadiene-methyl methacrylic acid type, polyvinyl acetate etc., or synthetic adhesives, e.g., polyvinyl alcohol, maleic anhydride-styrene copolymer, isobutene-maleic anhydride copolymer, acrylic acid-methacrylate copolymer, etc. are added at an amount of 10-30 parts by weight to 100 parts by weight of pigments, and coating solutions containing, if necessary, various additives such as dispersing agents, thickening agents, water retaining agents, antifoaming agents, waterproofing agents, lubricants, dyes, pH controlling agents, etc. are used.

[0022] The coating amount of the coating solution on base paper is generally 2-50 g/m<sup>2</sup> per one side as a dry basis, but it is desired to control to a range of 5-30 g/m<sup>2</sup> under consideration of white paper quality, printing aptitude, etc. of coating paper.

[0023] Further, those may be used as an undercoat, and at this time the topcoat may have a one layer structure or a multi-layer structure with two layers or more. The coating mode for topcoat is not restricted to any particular one, and various coating modes such as blade coater, air knife coater, rod coater, etc. can be used.

[0024] In addition, the coated printing paper prepared as above is dried to a water content of 3-10% by weight and press finished by passing through on- or off-super calender or soft calender, etc.

[0025]

[Application examples] Hereinafter, the present invention is explained further in detail by application examples, but the present invention is not limited to those only. "Parts" and "%" in application examples are all based on the weight.

[0026] Application example 1

Starch phosphate (MS 4600) 4 parts and a styrene-butadiene copolymer latex 10 parts as an adhesive were added to a dispersion obtained by dispersing highly white first grade kaolin (UW-90) 20 parts, second grade kaolin (HS) 30 parts and heavy calcium carbonate (Carbital 90) in a dispersing machine using a polyacrylic acid type dispersing agent (Aron T-40), and the pH was adjusted to 9.5 to obtain a coating solution. After adjusting the solids concentration to 50%, the coating solution was coated on both side of a base paper made with at least 50% wastepaper at a coating velocity of 1300 m/min and a coating amount per side of 15 g/m<sup>2</sup> using a curtain coater and calendered to give a coated paper for printing. Test results are shown in application example 1 of Table 1.

[0027] Application example 2

A coated paper for printing was obtained in the same manner as in application example 1 except that a base paper prepared using 100% wastepaper was used and the solids concentration of the coating solution was 65%. Test results are shown in application example 2 of Table 1.

[0028] Application example 3

A coated paper for printing was obtained in the same manner as in application example 1 except that a base paper prepared using 75% wastepaper was used and the solids concentration of the coating solution was 75%. Test results are shown in application example 3 of Table 1.

[0029] Application example 4

A coated paper for printing was obtained in the same manner as in application example 3 except that the solids concentration of the coating solution was 70%. Test results are shown in application example 4 of Table 1.

[0030] Comparative example 1

A coated paper for coating was obtained in the same manner as in application example 1 except that a coating solution with a solids concentration of 50% was coated at a coating velocity of 1300 m/min on a base paper made with 50% wastepaper using a blade coater. Test results are shown in comparative example 1 of Table 1.

[0031] Comparative example 2

A coated paper for coating was obtained in the same manner as in application example 1 except that a coating solution with a solids concentration of 65% was coated at a coating velocity of 1300 m/min on a base paper made with 100% wastepaper using a blade coater. Test results are shown in comparative example 2 of Table 1.

[0032] Comparative example 3

A coated paper for coating was obtained in the same manner as in application example 1 except that a coating solution with a solids concentration of 55% was coated at a coating velocity of 700 m/min on a base paper using an air knife blade coater. Test results are shown in comparative example 3 of Table 1.

[0033] Comparative example 4

It was attempted to prepare a coated paper for printing in the same manner as in application example 1 except using a coating solution with a solids concentration of 71%, but curtain cracking occurred so that a coated paper could not be obtained. Test results are shown in comparative example 4 of Table 4.

[0034]

Table 1

	Application example				Comparative example			
	1	2	3	4	1	2	3	4
Application amount of wastepaper (%)	50	100	75	75	50	100	50	50
Coating mode	curtain	curtain	Curtain	curtain	blade	blade	air knife	curtain
Solids content in coating solution (%)	50	65	55	70	50	65	55	71
Coating velocity (m/min)	1300	1300	1300	1300	1300	1300	700	1300
Coating defect of coated paper	none	none	none	none	many	many	none	cracking

[0035] The evaluation of the coating defect of coated paper for printing was carried out by visually evaluating the condition of the coated surface.

[0036] In application examples 1-4, coating could be carried out at a coating velocity of 1300 m/min, but the coating velocity in comparative example 3 was 700 m/min and its efficiency was bad.

[0037] No coating defect was formed in application examples 1-4, but in comparative example 1 and comparative example 2 the coagulated material of the coating solution was adhered to the blade tip to form many stripe-like coating defects on the coated surface. Further, in comparative example 4, the curtain was cracked so that the coating solution could not be coated on the base paper.

[0038]

[Effect of the invention] As explained above, a coated printing paper containing a large amount of wastepaper can be provided with a high-efficiency productivity equal to that of blade coating by using a curtain coater as a coating mode according to the present invention.

#### Brief explanation of drawings

Figure 1 is a schematic drawing for a curtain coater utilizing an extrusion type coater head as an application example of the present invention.

Figure 2 is a schematic drawing for a curtain coater utilizing a slide type coater head as another application example of the present invention.

[Explanation of symbols]

- 1 Coater head
- 2 Slit
- 3 Lip
- 4 Curtain membrane
- 5 Web
- 6 Slide surface
- 7 Manifold
- 8 Roll
- 9 Air intercepting plate
- 10 Liquid receiving tank
- 11a, 11b Edge guide
- 12 Storage tank
- 13 Liquid feed pump

【図1】

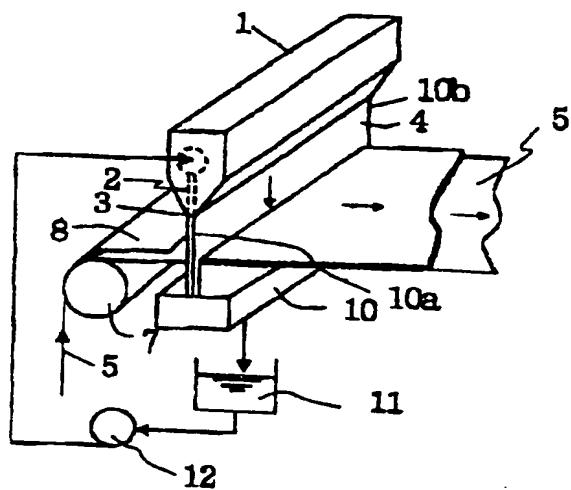


Figure 1

【図2】

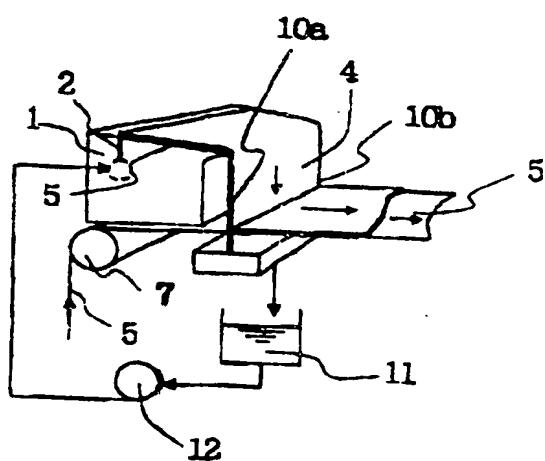


Figure 2